PROSPECTUS OF THE SUBCOMMITTEE ON SEDIMENTATION FOR THE YEARS 2007 – 2012

U.S. Department of the Interior
- Bureau of Land Management
- Bureau of Reclamation
- Geological Survey
- National Park Service
- Office of Surface Mining

U.S. Department of Agriculture
- Agricultural Research Service
- Forest Service
- Natural Resources Conservation Service

U.S. Department of Defense
- Department of the Army, Corps of Engineers

U.S. Department of Transportation
- Federal Highway Administration

U.S. Environmental Protection Agency

American Society of Civil Engineers

Colorado Water Resources Research Institute

Universities Council on Water Resources
- Institute of Water Research

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I. INTRODUCTION

This prospectus describes the major sediment issues confronting the nation, the structure of Subcommittee on Sedimentation (SOS), and the SOS activities to coordinate and share data, and other information, to help address these national issues.

A. Purpose and Scope

The purpose of the prospectus is to help define the issues confronting the Federal sector that relate to sedimentation and the ways and means by which SOS may effectively coordinate the combined effort of the participating agencies in addressing these issues.

The scope of the prospectus is any sedimentation issue of relevance to multiple SOS organizations. The sedimentation issues normally focus on fresh-water systems but can extend to estuaries and the coastal zone.

B. History

Sediment-discharge measurements in the United States began in 1838 when Captain Talcott sampled sediment from the Mississippi River. In the late nineteenth century, sediment-sampling activities increased rapidly as Federal agencies organized civil-works programs. For the most part, engineers in charge of these early sediment-monitoring programs developed their own sampling equipment and data-collection methods. By the 1930's, agencies had started to develop equipment and metrologies for use by their agency, but there was little consistency among the instruments and techniques used between agencies. As sampling progressed, managers realized the accuracy and usability of sediment data were affected by a lack of standardization in equipment and techniques. In 1939, the U.S. Department of Agriculture, Bureau of Reclamation, Office of Indian Affairs, U.S. Geological Survey, U.S. Army Corps of Engineers, and Tennessee Valley Authority formed the "Inter-Departmental Committee." This committee was formed to oversee a project that would investigate sediment-sampling equipment and techniques with the purpose of developing standardized ways of measuring and analyzing fluvial-sediment loads. From the time of its conception until the present day, this committee has served under several different parent organizations. These include the Federal Interagency River Basin Committee, Interagency Committee on Water Resources, Water Resources Council, and Interagency Advisory Committee on Water Data (IACWD). The IACWD, an advisory committee to the Secretary of the Interior and administratively organized by the USGS Office of Water Data Coordination, was replaced by the Advisory Committee on Water Information (ACWI) in 1996, and the currently named SOS was rechartered under the ACWI in 2004.

The long-term goals and objectives of the SOS are listed in section III. A.

II. SEDIMENT ISSUES CONFRONTING THE FEDERAL SECTOR, 2007

The nation's sediment issues can be linked through a watershed or river basin perspective, which in many cases involves coastal sediment processes. Listed below is an outline of the sediment issues that need to be addressed when considering management of our nation's watersheds and river basins:

- Sediment Production from Land-Use Change.
  - Sediment-related Hazards.
  - Environmental Concerns.
- Reservoir Sedimentation.
- River Channel Processes.
  - Port and Channel Operation and Maintenance (including dredging).
  - Dam Removal or Rehabilitation.
  - Geomorphic Responses.
  - Interstitial Hydraulics and Sediment Movement.
- Coastal Processes.
  - Coastal Sediment Delivery and Management,
  - Effect of Episodic Events on Coastal-Sediment Transport and Morphology.

The advanced development and sharing of information and consolidated sediment databases for terrestrial, riverine, and coastal environments will be an essential tool for evaluating watershed sediment issues. Additionally, identifying sediment research, monitoring, and data-collection needs should eventually lead to the development of new methods and technologies.

A. Sediment Production from Land Use Change

All of the water-development and resource-management agencies are concerned with the ability to adequately predict the change in sediment production associated with changes in watershed land and water use. Sediment must be considered a resource that can be a problem if in excess (for example, it may reduce the waterway opening of bridges and culverts) or is in insufficient quantities. Examples include the loss of Gulf coast estuaries due to reduced sediment delivery, compounded with continued compaction of sediments, and degrading streams that may affect the stability of bridge foundations.

1. Sediment-Related Hazards

Under certain extreme conditions, sediment is transported in modes and rates that can have severely damaging results. Because of the rarity and extreme conditions under

which they occur, it is particularly difficult to sample and monitor these phenomena. Specifically identified are:

- Debris flows.
- Landslides.
- Scour of bridges and other hydraulic structures.
- Reduced waterway openings of bridges and culverts.

2. Environmental Concerns

The adverse environmental consequences of land use on erosion and nonpoint-source sediment from agricultural, forestry, and urban sources remains an area of national concern. Issues of contaminated sediments, that pose threats to biological resources, are increasingly coming to the forefront. Water-resource development and compliance with clean water standards (for Total Maximum Daily Load criteria) require an increased awareness of sediment-transported contaminants and the sensitivity required in collecting and analyzing these data. The fate of these contaminants in deposited sediment is of particular importance. Specific problems identified include:

- Measurement of transport of contaminants attached to sediment particles including those at low concentrations.
- Fate and transformation of contaminants during removal and upon disposal.
- Salinity changes related to sediment transport and dissolution.
- Sediment-related problems associated with Superfund Cleanup sites and their remediation.
- Nonpoint source sediment.
- Continued expansion of urban areas.
- Shift to more intensive agriculture practices.
- Energy development including increased coal mining.
- “Clean” sediment TMDL targets and development.
- River corridor restoration guidelines and organization coordination. This includes the special condition of dam decommissioning and removal.
- Effects of climate change on sediment production.

B. Reservoir Sedimentation

Most U.S. dams and reservoirs were built in the early to middle decades of the 20th century, and the storage capacity has been steadily depleted. Thousands of smaller flood control reservoirs were designed in the 1960’s and 1970’s with 50- to 100-year design lives, with sediment storage designed accordingly. Rehabilitation, replacement,

or decommissioning of some of these structures is currently underway, with many more to be evaluated in the next decade. Existing storage and new storage, particularly in larger reservoirs must be carefully managed, since few opportunities exist to replace this storage. Therefore, it is important that:

- The total-sediment inflow can be accurately monitored for effects on individual reservoirs, as well as an indicator of regional sediment production conditions.
- The rate of consolidation of the inflowing sediment can be predicted and monitored.
- The effect of shoreline erosion on storage change and shoreline development can be predicted and controlled.
- Decommissioning of obsolete facilities is studied and guidelines produced, both for individual structures and for structures as integral parts of water-resource systems.
- Rehabilitation plans include appropriate testing of the quality of sediment to be removed to determine potential effects on the water column, downstream impacts, and disposal areas.

C. River Channel Processes

1. Port and Channel Operation and Maintenance

Many natural and constructed channels are used for the conveyance of water, providing flood control and recreational opportunities, and as navigation routes. Several of the participating Federal agencies are charged with operating and maintaining these watercourses, ports, harbors, and their appurtenant structures. Dredging of ports and harbors is a matter of national security, as well as national economics, since ports and harbors are the entry and exit points for military deployment, as well as international markets for agricultural, mined, and manufactured goods. Budgetary restrictions and increased-use pressures make it critical that these ports and channels are operated and maintained in both a scientifically sound and economical manner. Consequently it is important that:

- Aggradation and degradation can be predicted and measured.
- Bank erosion rates can be predicted and monitored, and that appropriate means of bank stabilization can be designed and economically constructed.
- Bedload-transport rates can be measured in difficult hydraulic and sediment-transport situations.
- Dredging, disposal, and beneficial use of spoil material be accomplished at least cost and in an environmentally sensitive manner.
- Watershed sediment managers coordinate with navigation project managers and coastal sediment managers.

2. Dam Removal or Rehabilitation

Reservoirs formed by over 79,000 dams (that are at least six feet in height) exist in the United States today, serving many different purposes including:

- water supply for irrigation, stock watering, municipal, industrial, and fire protection needs;
- flood control;
- navigation;
- recreation;
- hydroelectricity;
- water power;
- river diversion;
- sediment and debris control; and
- waste disposal.

While the great majority of these dams still provide a vital function to society, some may need to be decommissioned for reasons that include:

- Economics.
- Dam safety and security.
- Legal and financial liability.
- Ecosystem restoration (including fish-passage improvement).
- Site restoration.
- Recreation.

Some dams no longer serve the purpose for which they were constructed. When a dam has significantly deteriorated, the costs of repair may exceed the expected benefits and dam removal may be a less expensive alternative. If fish cannot adequately pass upstream of the dam and reservoir, the cost of adequate fish passage facilities might exceed the project benefits and dam removal may be a less expensive alternative. Some dams and reservoirs may inundate important cultural or historic properties and dam removal may restore those properties. Along some rivers, the demand for white-water recreation might be a compelling reason to remove a dam.

The management of reservoir sediment is often an important and controlling issue related to dam removal. Sediment erosion, transport, and deposition are likely to be among the most important physical effects of dam removal.

The sediment-related impacts associated with dam decommissioning could occur in the reservoir and in the river channel, both upstream and downstream from the reservoir. Depending on the local conditions and the decommissioning alternative, the degree of impact can range from negligible to very large.

3. Geomorphic Responses

When the flow regime and related sediment-transport rates are altered in natural streams, it triggers a geomorphic response that can manifest itself in several ways. Aggradation; degradation; changes in channel alignment, slope, sinuosity, and planform; bank erosion; and altered channel substrate are among the potential responses. The ability to predict and compensate for these changes can minimize environmental impacts and suggest appropriate preventive or mitigative measures. Among the most important actions to predict and compensate for these changes are:

- Predicting long-term changes in river channel alignment, slope, sinuosity, and planform.
- Understanding the nature and control of local channel processes for better restoration planning and design.
- Ability to predict and counter changes in riparian and aquatic habitat.
- Assessing the impact on conjunctive wetlands, estuaries and coastal waters.

4. Interstitial Hydraulics and Sediment Movement

Of particular importance to the maintenance of spawning gravels and habitat are the hydraulics of water movement and, hence, sediment movement between the substrate particles. The requirements for flushing and maintenance flows are dependent on these parameters.

D. Coastal Processes

Various regional processes that control or restrict coastal sediment transport include:

- Longshore and cross-shore sand transport.
- Transport during storms.
- Wind-blown sand transport.
- Cliff and dune erosion.
- Sediment supply from rivers.
- Sediment losses to submarine canyons.

These regional processes and controls determine coastal sediment-transport patterns and shoreline evolution, and can increase coastal vulnerability and reduce navigation channel performance. Inlet navigation projects; typically including jetties, channel-maintenance dredging, and disposal of dredged material; are a major element of the coastal sediment budget. Many inlet navigation projects have been in place for more than a century, and their ranges of influence far exceed local project dimensions. Similarly, sand from periodically nourished beaches likewise will travel far beyond project limits. The time and space scales of major coastal projects therefore call for regional considerations to address the full consequences and interaction of engineering activities as well as the wide-scale influence of natural processes and features. Traditional project management practices that focused solely on local sediment management actions have often had unintended consequences because they may not have considered regional sediment-transport sources and dynamics. However, regional sediment-management strategies which recognize that sediment is a resource and employ a systems-based approach can be implemented to effectively manage sediment for multiple objectives and long-term system sustainability. Regional sediment management promotes management of littoral, estuarine, and fluvial sediment within the boundaries of a physical system where sediment exchange occurs naturally. Therefore, the successful implementation of regional sediment-management strategies requires knowledge of the regional sediment transport sources and dynamics.

1. Coastal Sediment Delivery and Management

The operation of ports and harbors, as well as their access channels, is a matter of national security for moving goods and services, as well as the national economy. Management of dredged materials is being emphasized over simple disposal or dumping. Alternative uses for dredged materials are being evaluated and tested, such as for constructing wetlands or islands, replenishing borrow areas used for bolstering dikes and levees, and for producing building materials. The fact that approved areas for disposal of dredged materials are dwindling in number and size points to the need to find alternate solutions as to what to do with dredged materials. Therefore, it is important that:

- Dredged materials should be managed as a resource using life-cycle dredged material management plans that consider regional sediment management needs; dredging frequencies, locations, and quantities; as well as landscape use and change.
- Government and private entities that develop and execute projects requiring dredging should be stewards for the beneficial use of dredged materials.
- Planning for navigation projects should be based on objectives of environmental sustainability and minimization of life-cycle costs, optimizing the beneficial use of dredged material and pursuing opportunities where project objectives also maintain key environmental processes.
- All clean dredged sediment should be used beneficially unless it is clearly impractical to do so.

2. Effect of Episodic Events on Coastal -Sediment Transport and Morphology

Hurricanes and other extreme storms generate storm surge and large waves, eroding the beach and dune system and reshaping the coastal landscape. During the most extreme events, changes can occur across the width of an entire barrier island. Significant coastal change occurs through the processes of beach erosion, dune erosion, overwash, inundation, marsh erosion, and coastal cliff erosion. During storm events, these processes can result in the loss of large volumes of sediment from the littoral zone, thereby, increasing the vulnerability of coastal structures, infrastructure, and ecosystem components to catastrophic damage during subsequent storm events. Therefore, it is important to:

- Develop regional sediment budgets that describe sediment-transport pathways, sources and sinks for coastal sediments.
- Characterize the vulnerability of coastal reaches to storm impacts based on morphology and risk due to storm surge and wave attack.
- Promote coastal management strategies that preserve sediment within the vulnerable littoral zone.

E. Database Management

With the continuous increase of information and the speed by which it can be communicated, database management has turned out to be an increasingly important problem. Achieving consistency in managing databases for sharing with others is probably as important a problem today as standardization of sampling equipment and procedures was in the past.

III. SUBCOMMITTEE STRUCTURE AND ACTIVITIES TO ADDRESS ISSUES

All Federal agencies and non-Federal organizations with interests in sedimentation are welcome to participate in the Subcommittee on Sedimentation as described in the SOS Terms of Reference (http://acwi.gov/sos_TORS_9_23_2003.pdf). Representatives on the SOS generally are managers, supervisors, or technical specialists with sufficient background to convey overall views of their organization's sediment-related activities and issues. The SOS members jointly provide vision, leadership, and general guidance on sediment issues of interest to participating organizations.

The SOS provides a vehicle for Federal agencies and organizations to share information on technical issues. The sharing of information, and jointly conducted investigations, serve to combine resources and minimize duplication of efforts by the organizations.

A. SOS Goals

The long-term goals and objectives of the SOS are to:

- Determine the major sediment-related problems and issues facing the United States in the 21st century.
- Coordinate the development of countermeasures to reduce sediment problems on our water resources.
- Provide standardized information and data that are scientifically defensible for policy-makers.
- Coordinate and pool the resources of the participating agencies in order to effectively share information and consolidated sediment databases and address important sediment problems.
- Promote the analysis of sediment data from a watershed or river basin perspective.

Short-term goals are to be discussed and planned during the Subcommittee's meetings and conference calls.

The major technical and coordination activities of SOS are described in the following sections.

B. Technical Activities

1. Standards

A major objective of the SOS, in coordination with the Technical Committee of the Federal Interagency Sedimentation Project (FISP), is to promote standardization of equipment and technical procedures related to sediment-data collection and interpretation. Other areas of standardization promoted by the SOS include procedures for sampling and monitoring of suspended sediment and bedload, measurement of deposition in water bodies, quality assurance, and numerical modeling of sediment and related characteristics.

Identifying sediment research, monitoring, and data-collection needs should eventually lead to the development of new technologies. As of 2007, the FISP has been in existence for two-thirds of a century and is responsible for the development of the traditional sediment-measuring equipment available today and new sediment-measuring and -monitoring technologies. The Technical Committee that oversees the FISP is comprised of Federal Agencies and is independent of the SOS. However, most of the Federal Agencies on the SOS are also represented on the FISP Technical Committee. In addition, a representative from FISP has a standing invitation to attend SOS meetings. Through these contacts, the SOS identifies sediment-monitoring and data-collection needs to FISP Technical Committee.

2. Database/Software

A work group will be formed to coordinate data exchange, the development of standardized databases, the application of quality control procedures, and standardized software for accessing sediment data.

One function of the work group will be to coordinate the development and access to databases similar to the long-term monitoring of reservoir sedimentation associated with the Reservoir Information System (RESIS) prior to 1992. The transition from the need for printed data to electronic data has already occurred. The work group can assist in the coordination of the data exchange.

There is commonality among fluvial mechanics among the world's rivers. Thus, data on sediment-transport and -deposition processes in one river can help elucidate these processes in other rivers. Furthermore, fluvial-sediment databases are numerous world-wide. The work group can work with other organizations on a national and international basis with interest in sediment databases to identify and, where feasible, provide access (including search engines) to fluvial-sediment databases.

3. Environmental

Historically the SOS has been mainly concerned with the physical problems associated with sediment transport, i.e., reservoir sedimentation or damage to structures or

systems caused by erosion or deposition. As water resources become more developed, society often asks for existing water-resource projects to be operated for purposes not considered when they were designed (recreation, pollution dilution, aesthetics, maintenance of fisheries or other habitat). Also, as the demand for cleaner water resources increases, the emphasis in data collection is broadening to include, not only physical quantities (sediment yield, erosion and sedimentation rates), but environmental effects and outcomes, including chemical and biological quantities (TMDL's, fluxes of chemicals sorbed to sediments, reservoir-contamination, distribution of sediment as it relates to habitat, aesthetic qualities of the water and riparian area). This change in emphasis requires identification and development of new equipment for measurement and methods of analysis.

C. Communication/Coordination Activities

One of the functions of the SOS is to foster the exchange of information among the participating agencies. It is proposed that all agencies participate by making presentations regarding program initiatives and special research that are of interest to the SOS members. Such presentations would keep the SOS abreast of current developments and provide a forum for feedback to the presenting organization. Each SOS meeting would incorporate a single presentation of one-hour or less duration with an opportunity for discussion. The presenting organization will prepare a companion narrative with illustrations, if appropriate, which will be posted with the meeting minutes on the SOS website. Presentation topics will be discussed during SOS meetings in preparation for the next SOS meeting. All SOS members are welcome to suggest topics during the meeting or to the Subcommittee Chair.

To help accomplish the SOS's goal of disseminating and sharing information among the Federal agencies and with State, local, and private entities, the Subcommittee has held major national inter-agency sedimentation conferences about twice per decade. In addition, the Subcommittee will annually update and maintain a bibliography of sediment-related reports prepared by member organizations, annually update and maintain a reservoir sedimentation database, and conduct periodic technical workshops.

1. Sedimentation Conference

The SOS sponsors a Federal Interagency Sedimentation Conference (FISC) that draws attendees from around the world. Eight of these conferences have been conducted since 1947, with those from 1986-2006 taking place every 5 years. The 2006 conference was held jointly with the ACWI Subcommittee on Hydrology (SOH). Both Subcommittees decided to continue the Joint Federal Interagency Conference (JFIC) format every 4 years with the next FISC planned for 2010. Each conference requires a considerable amount of planning and coordination effort by the staffs of participating agencies, as well as by SOS members. Activities required to convene and conduct the FISC include:

a. Initial Planning Committee responsibilities include:

- Determining dates of the FISC.
- Selecting sites--city and hotel.

b. General Committee responsibilities include:

- Overall planning and scheduling the FISC.
- Coordinating the Technical and Operational Programs.
- Coordination with JFIC.

c. Technical Program Committee responsibilities include:

- Determining central theme.
- Developing preliminary issues and topics.
- Preparing Call for Papers and other FISC announcements.
- Reviewing abstracts.
- Developing technical programs.
- Reviewing papers.
- Preparing FISC proceedings.
- Scheduling and managing FISC sessions and programs.
- Planning and managing technical tours.

d. Operational Committee (OC) will be a single committee for the JFIC, consisting of members from both SOS and SOH. The responsibilities of the OC include:

- Developing JFIC budget and accounting procedures.
- Maintaining separate SOS and SOH bank accounts.
- Collecting all Conference fees.
- Paying all JFIC bills.
- Maintaining all JFIC financial records.
- Developing registration procedures.
- Managing registration.
- Printing and distributing Call for Papers, announcements, and proceedings.
- Developing and managing non-technical activities (receptions, spouse programs, etc.) and tours.
- Planning and managing JFIC exhibit program.

2. Notes on Sedimentation Activities (Bibliography Database)

The need for disseminating current information on activities in the field of sedimentation was proposed by the Chairman of the Federal Interagency River Basin Committee's Subcommittee on Sedimentation shortly after it was formed in May 1946. On September 17, 1946, the members approved this proposal and agreed to the issuance of a quarterly report as one means of effecting better coordination in the work of various Federal agencies in the field of sedimentation.

Quarterly reports were issued during the period of July 1, 1946 through June 30, 1947, when the reporting period was changed to a 6-month period, and semiannual reports were issued through 1953. Starting in 1954 and continuing through 1992 these reports were made annually and cover the activities of the federal agencies in the field of sedimentation on a calendar-year basis.

The extant Notes on Sediment Activities represent a digest of information furnished by Federal agencies conducting sedimentation investigations on work in progress or planned, important findings, new methods, new publications, laboratory and other research activities, and other pertinent information. The material is organized by drainage regions. There is also a section on research and other activities. The development of this report each year was a major undertaking for the participating agencies and documenting and publication of this information ceased in 1992.

In order to foster the sharing of technical information among member organization, the Subcommittee will create, update, and maintain a bibliography of sediment-related reports prepared by member organizations. The bibliography will be presented in a database format and accessed through a website. The bibliography database will be maintained by a standing workgroup. Each SOS member organization will be responsible for submitting their bibliography list, in the data-base format, along with key words selected from a list provided by the workgroup. The database will be accessible from one of the SOS member organization websites or the Federal Interagency Sedimentation Conference website.

3. Sediment Deposition in Reservoirs Information

Reservoir sedimentation is an increasingly serious problem worldwide. The worldwide average annual rate of storage loss due to reservoir sedimentation is on the order of 0.5 to 1 percent of the total reservoir storage. In the United States, the average annual rate of reservoir sedimentation has been estimated to be about 0.2 percent of total reservoir storage capacity. Sedimentation often has negative effects on water resources development projects. However, advance comprehensive project planning and careful on-site operation and management can greatly reduce these effects.

In the United States, direct field survey and indirect analytical methods are used to determine the amount of sediment deposition in reservoirs. In 1934, the Soil Conservation Service (SCS) established standard procedures for measuring the

accumulated volume of sediment in a reservoir, in connection with a nationwide study of reservoir sedimentation. Today, survey-grade G.P.S. instruments and depth sounders are commonly used to measure reservoir bathymetry.

In general, the purpose of a reservoir sedimentation survey is to measure the accumulated volume of sediment in a reservoir during the period of storage record by comparison with previous surveys. This information is useful for:

- Incorporating the prevailing and future sedimentation impacts in engineering planning, analysis, and design, including the possibility of decommissioning.
- Periodically modifying the reservoir capacity curve to insure more efficient operation.
- Preparing regional sediment-production indexes.
- Evaluating the cumulative impacts of erosion, resources developments, and soil conservation efforts in a watershed.
- Developing and evaluating potential countermeasures to prevent or reduce the amount of river and reservoir sedimentation.

In order to promote a uniform assembly of the data, a set of data forms and instructions for compiling reservoir sedimentation data has been developed by the SOS. The forms are designed to capture 50 pieces of information related to each survey, including information on characteristics of dam and reservoir, survey data, date of survey, organization conducting the survey, etc. SOS will begin to update and maintain RESIS, the reservoir sedimentation relational database, using data supplied by member organizations. Each member organization will be responsible for submitting their reservoir sedimentation data, in the proper data-base format to a standing workgroup. The database will be accessible from one of the SOS member organization websites or the Federal Interagency Sedimentation Conference website.

4. Workshops

The Subcommittee on Sedimentation will sponsor or co-sponsor technical workshops on topic of special interest to member organizations. Ad-hoc work groups will be formed to coordinate the holding of various workshops and symposia on sediment-related subjects. These meetings are to be on more focused topics than the 4-year (post-2006) FISC series. Examples of activities of this type in recent years are the Bridge Scour Symposium, Bilateral Workshop on Understanding Sedimentation Processes and Model Evaluation, Sediment Technology for the 21st Century Workshop, Turbidity and Other Sediment-Surrogates Workshop, Federal Interagency Sediment Monitoring Instrument and Analysis Research Workshop, and International Bedload-Surrogate Monitoring Workshop.

The workshops primarily will be to foster technical information exchange among workers in subjects related to sedimentation or other missions of the parent ACWI. Registration

fees will be kept to a minimum. Participation at technical workshops by sedimentation scientists and engineers from member organizations will be encouraged.